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March 2013 | Volume **70** | Number **6**
Technology-Rich Learning Pages 28-31

A Bold New Math Class

Salman Khan and Elizabeth Slavitt

Khan Academy offers just what students need—the opportunity to learn at their own pace.

On the edge of an urban high school campus, in a large room that looks more like an open-plan design studio than a traditional classroom, 200 students sit at desks or on beanbag chairs, studying math. Many work quietly on their own or with a few peers nearby, their laptops fired up in front of them. In a breakout room off to the side, a boisterous group of teenagers works together while others listen attentively as their teacher explains quadratic functions. Across the way, in a smaller room that resembles a typical high school classroom, a dozen students take assessments to demonstrate their comprehension of specific concepts.

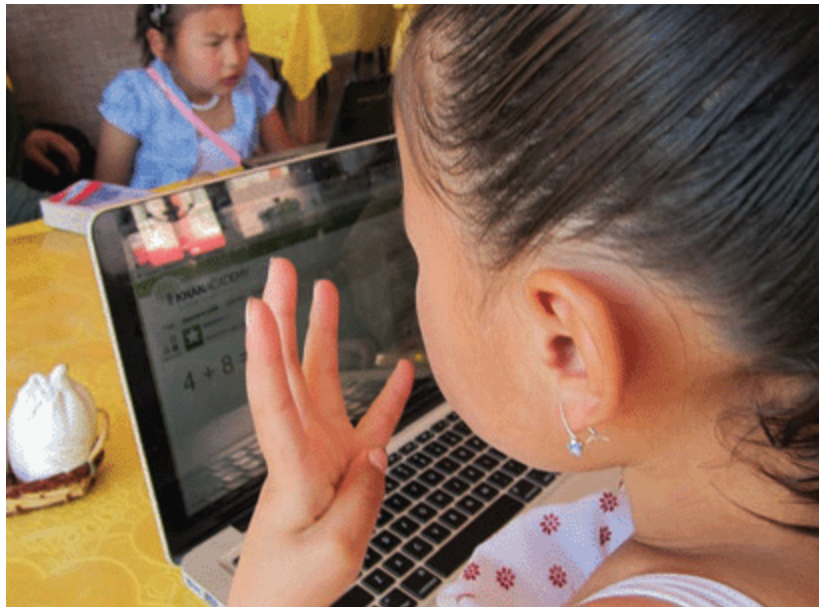
It's a typical day in math class at Summit San Jose, a socioeconomically and ethnically diverse charter school where 9th and 10th graders study math together, largely freed from the artificial separations that divide students into grade levels. Students study concepts as basic as those typically taught to middle school students and as complex as those ordinarily studied in 11th or 12th grade. Students use online resources, including [Khan Academy](#), to learn at their own pace. A team of seven educators designs and refines the curriculum, teaches tailored seminars, works individually with students, and checks students' progress through data and regular in-person meetings to facilitate a successful, multilevel, mixed-age math class.

For an observer walking around this classroom, it's hard not to take the aggregate view, to note the number of desks and breakout rooms, to perhaps feel a bit overwhelmed by the variety of activities occurring under one roof. But if you take the perspective of an individual student, everything about this classroom—from the physical setup, to the teachers' roles, to the materials presented to students, to the accountability systems—sends a clear message: You can and should learn at *your own pace*; and we will support you in taking responsibility for *your own education*. Because so much of the work we do at Khan Academy aims to encourage and enable self-paced, mastery-based, and interactive learning, we're thrilled to see educators at a school in our own backyard use our content to invent a new classroom model focused on this type of learning.

Summit San Jose is part of the Summit Public Schools network, a group of charter schools in California's Bay Area. In 2011, when Summit San Jose first opened its new high school with a cohort of 9th graders, the teachers decided to pilot Khan Academy. At the time, we had piloted our math resources and platform with five classrooms in Los Altos, a nearby public school district, and we were eager to learn how other types of schools could effectively use our site.



Above left, three 6th grade boys from Eastside College Prep in East Palo Alto, California, use Khan Academy material for a self-paced curriculum. Above right, Sal Khan visits a 7th grade classroom using Khan Academy at Egan Middle School in the Los Altos, California, School District. Below, 8-year-old children in a Mongolian orphanage learn math on Khan Academy.



PHOTOS COURTESY OF KHAN ACADEMY

How It Works

Khan Academy is best known for its collection of 3,500 videos, but its math practice problems and real-time reports are also heavily used in classrooms. Depending on factors like access to technology and flexibility of their curriculum, teachers in our pilots have developed a range of ways to use Khan Academy. In many cases, students use our math exercises, a series of practice problems that weave a narrative from basic arithmetic through calculus, to refine their math skills, remediate, or race ahead. While working on math exercises, students can use step-by-step hints, watch related videos, and find out immediately whether they answered a question correctly. Using the knowledge map, a hierarchy of concepts proceeding from more basic to more complex, students can also see what they should work on next.

For example, a student learning about prime numbers might watch a video on that topic (each video is about 10 minutes long) before going on to a series of practice problems. Stumped by one of the questions, the student may need a hint along the way, such as a reminder that "a prime number has exactly two factors: 1 and itself." As they work, students and their teachers access real-time reports that summarize student progress and provide detailed information about their answer history—for instance, which questions they answered right or wrong, how long they took to answer, whether they needed a hint along the way, and whether they watched a video.

Giving students access to data about their progress empowers them; it helps them learn to interpret charts and develop action plans to bridge their knowledge gaps. For instance, a student might see that when he spent more time on math problems after school he finally mastered a challenging concept or that her performance tended to improve after she watched a video. Seeing that information visually in charts helps students make informed decisions about their study skills. For teachers, having such rich data about students' progress at their fingertips enables them to spend time with students in the most efficient and effective ways.

Summit San Jose

At the beginning of the pilot in Summit San Jose in fall 2011, the three 9th grade teachers gave their students additional time each day to work on the Khan Academy site. Many students dove in and engaged with the content, whereas others needed more direction from their teachers. To ensure that students were using this time effectively, teachers began asking students to write weekly goals for their work on Khan Academy, such as which exercises they planned to complete or which videos they planned to watch. Soon, students at Summit were not only improving their math skills, but also learning to take ownership over their education. We were so impressed by the impact of paper-and-pencil goal setting at Summit and other schools that we built a goal-setting feature on our site; now anyone can set a customized goal on Khan Academy and work to achieve it.

As the year progressed, the 9th graders at Summit learned math at a range of paces and in a variety of ways. Some students thrived when given free time to learn math without interruption; others needed personalized attention from their teachers. Some students sought guidance from a Khan Academy video, a textbook, or a peer when they got stuck; others wanted their teacher to review the concept with them. Students' preferences were not always consistent from one concept (or even one day) to the next. Although some students consistently learned much faster or slower than their peers throughout the year, many students' learning speeds varied by concept or unit. Also, because updated charts indicated each student's status daily, teachers knew where students needed them most.

Summit's use of Khan Academy led to outstanding results, in terms of both students' study habits and their test scores. At the end of the year, on Northwest Evaluation Association's Measures of Academic Progress exam, Summit scored in the 85th percentile for student growth.

Eastside College Preparatory School

Other pilot schools had similar experiences. Take Eastside College Preparatory School in East Palo Alto, California, a tuition-free independent school for students who would be the first in their families to attend college. There, middle school teachers Suney Park and Jen Johnson discovered that once the students in their classrooms began using Khan Academy, they split into several cohorts. Many students learned the content at the same speed at which Suney or Jen would have taught the lessons previously. Several students, however, sped ahead, mastering the content on Khan Academy worksheets and textbook assignments far faster than the curriculum dictated. Still others needed far more time than allocated during class to learn the prescribed content. Students who might ordinarily have earned Cs or Ds stayed after school in the computer lab to review videos and math practice questions in areas they needed to work on, and they requested time with Suney or Jen to address their misconceptions and squeeze in extra practice.

At first, it was jarring for the teachers to have students working on different content in one classroom. After all, as opposed to the approach of Summit San Jose in which a team of several teachers work with 200 students, at Eastside College Preparatory School there was still just one teacher in a room full of students. It was challenging to preplan lessons when students were working at different levels.

However, over time, the teachers found a rhythm that worked. They prepared assignment sheets that drew from Khan Academy, their textbooks, and other resources, and they developed rich and engaging projects for students to do at the end of a unit, such as deploying their newfound skills in using fractions to design mock buildings. In many cases, they taught the introductory material in a unit to their entire class and covered subsequent lessons in small groups as students became ready for them. If students were able to learn content with Khan Academy and other resources, they did so; if they needed help, they learned to ask for it. Students also volunteered to assist others with challenging concepts. Not only did the students feel good about helping one another, but they also earned the praise of their teachers, who told them that explaining something to someone else is the best way to master it.

The idea of students moving at their own pace is now ingrained in the class culture. For example, in Suney's 6th grade class, posters with such titles as "Fractions Land" and "Decimals Land" hang from the ceiling; students move personalized clothespins from poster to poster as they progress through the curriculum. There is no shame in being on any particular land; students simply move at their own pace.

Making Self-Paced Learning Work

At the beginning of the 2012–13 school year, students at Summit San Jose took a diagnostic exam, which teachers used to develop a tailored math curriculum for each of them. As students learn specific concepts, they have the opportunity to take assessments to demonstrate their mastery; they receive higher grades for passing exams *plus*

completing related projects, which demonstrate that they have engaged deeply with the content and have applied their newfound knowledge.

Like many urban charter school networks, Summit works hard to help its students gain admission to college. Teachers know that for students to succeed in higher education, they need to be able to ask for help and take responsibility for their own education, which is why those skills are emphasized so strongly in Summit's new model. If a student doesn't understand a concept, he or she is expected and encouraged to ask a peer or a teacher for help rather than sit back and hope the concept will eventually make sense.

Students learn to identify the study skills and learning methods that are most effective for them. Summit doesn't require students to sit through lectures or learn in any prescribed manner, as long as they learn the content and can prove their knowledge. Not only does this more accurately simulate and prepare students for the college experience, but also it demonstrates to students how much faith the school has in them to take ownership for their education. Summit expects that students will rise to the challenge.

Over time, Summit plans to continue to integrate deeper and more creative projects into its curriculum and enable students to pursue their interests through short internships at local companies. Students who are curious about software development, laboratory research, or aerospace engineering could spend time gaining real-world knowledge and skills down the block at Google, Stanford University, or NASA.

New Questions, New Directions

Even as Summit continues to determine the best way to make this model work, the teachers and leaders there have big questions to resolve: How can they ensure that all students work hard, challenge themselves, and get help when they're stuck? How do they build a collaborative learning environment that supports individual needs while also cultivating community? What if some students don't meet the state standards for their grade level? What if students zoom ahead and complete 12th grade math in 9th grade?

Keeping all students motivated and engaged, ensuring no one falls behind or is bored, helping all students maximize their potential—these needs are not unique to Summit. They're issues every school faces. However, Summit can now respond to them in a student-centric way. In fact, the school is so committed to this vision that plans are underway for developing a new charter school that will embrace the self-paced learning model across all disciplines and grade levels.

Like Summit San Jose, we at Khan Academy also have our work cut out for us. We're proud of the hard work of our small team that has produced math videos and exercises, an engaging learning platform, and real-time reporting, and we're excited about some of the recent additions to our site, including content in other disciplines and a computer science platform that emphasizes creativity and exploration. We know this is just the beginning, however. We need to design more cohesive learning experiences that help students understand what they know in a given topic area and what it will take for them to reach their goals in that area. We want Khan Academy to act as an active tutor, tailoring lessons and learning experiences to fit individual users' needs.

The Future Is Now

Khan Academy, along with other innovative online resources, is playing a fundamental role in reimagining education in a way that empowers teachers and students to build personalized, mastery-based, and interactive learning environments that foster creativity and collaboration. Eastside College Preparatory School and Summit San Jose demonstrate what's possible through their willingness to experiment with technology, their openness to new ways of organizing class time and physical space, their passion for meaningful projects and real-world experiences, and their intense focus on the needs of each student. We are excited to see them and other schools think and act boldly and creatively to construct classroom learning environments that help every student succeed.

Salman Khan is founder and executive director of [Khan Academy](#) and author of *The One World School House: Education Reimagined* (Twelve, 2012). **Elizabeth Slavitt** leads Khan Academy's work with schools.

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